

Dental - Caries

From HumanResearchWiki

Contents

- 1 Introduction
- 2 Clinical Priority and Clinical Priority Rationale by Design Reference Mission
- 3 Initial Treatment Steps During Space Flight
- 4 Capabilities Needed for Diagnosis
- 5 Capabilities Needed for Treatment
- 6 Associated Gap Reports
- 7 Other Pertinent Documents
- 8 List of Acronyms
- 9 References
- 10 Last Update

Introduction

Numerous oral and peri-oral pathologies may present with toothache, for example: dental caries, traumatic injuries (such as a cracked tooth), exposed pulp, pulpitis, periodontitis, and periodontal abscess to name just a few. Of these, dental caries are perhaps the most prevalent; bring one of the most prevalent chronic diseases worldwide, with individuals remaining susceptible to it throughout their lifetime. Approximately 91 percent of dentate adults 20 years or older have experienced dental caries.^[1]

Dental caries form through a complex interaction over time between acid-producing bacteria and fermentable carbohydrate, and many host factors including teeth and saliva. The disease develops in both the crowns and roots of teeth.^[2] The risk factors for caries include physical, biological, environmental, behavioral, and lifestyle-related factors such as high numbers of cariogenic bacteria, inadequate salivary flow, insufficient fluoride exposure, and poor oral hygiene.^[2] Despite the fact that astronauts receive excellent preventative dental care and screening, dental caries are still considered the most likely cause of toothache.^[3]

Clinical Priority and Clinical Priority Rationale by Design Reference Mission

One of the inherent properties of space flight is a limitation in available mass, power, and volume within the space craft. These limitations mandate prioritization of what medical equipment and consumables are manifested for the flight, and which medical conditions would be addressed. Therefore, clinical priorities have been assigned to describe which medical conditions will be allocated resources for diagnosis and treatment. “Shall” conditions are those for which diagnostic and treatment capability must be provided, due to a high likelihood of their occurrence and severe consequence if the condition were to occur and no treatment was available. “Should” conditions are those for which diagnostic and treatment capability should be provided if mass/power/volume limitations allow. Conditions were designated as “Not Addressed” if no specific diagnostic and/or treatment capability are expected to be manifested, either due to a very low likelihood of occurrence or other limitations (for example, in medical

training, hardware, or consumables) that would preclude treatment. Design Reference Missions (DRMs) are proposed future missions designated by a set of assumptions that encompass parameters such as destination, length of mission, number of crewmembers, number of Extravehicular Activities (EVAs), and anticipated level of care. The clinical priorities for all medical conditions on the Exploration Medical Condition List (EMCL) can be found here (https://humanresearchwiki.jsc.nasa.gov/index.php?title=Category:All_DRM). The EMCL document may be accessed here (https://humanresearchwiki.jsc.nasa.gov/images/6/62/EMCL_RevC_2013.pdf).

Design Reference Mission	Clinical Priority	Clinical Priority Rationale
<p>Lunar sortie mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> ■ 4 crewmembers (3 males, 1 female) ■ 14 days total ■ 4 EVAs/ crewmember ■ <u>Level of Care 3</u> 	<p>Shall</p>	<p>Although crewmembers are extensively screened pre-flight for dental conditions, dental problems may arise unexpectedly during the extended duration of the lunar sortie mission. Therefore, treatment capability shall be manifested.</p>
<p>Lunar outpost mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> ■ 4 crewmembers (3 males, 1 female) ■ 180 days total ■ 90 EVAs/ crewmember ■ <u>Level of Care 4</u> 	<p>Shall</p>	<p>Although crewmembers are extensively screened pre-flight for dental conditions, dental problems may arise unexpectedly during the extended duration of the lunar outpost mission. Therefore, treatment capability shall be manifested.</p>
<p>Near-Earth Asteroid (NEA) mission</p> <p>Assumptions:</p> <ul style="list-style-type: none"> ■ 3 crewmembers (2 males, 1 female) ■ 395 days total ■ 30 EVAs/ crewmember ■ <u>Level of Care 5</u> 	<p>Shall</p>	<p>Although crewmembers are extensively screened preflight for dental conditions, dental problems may arise unexpectedly during the extended duration of the NEA mission. Therefore, treatment capability shall be manifested.</p>

Initial Treatment Steps During Space Flight

A link is provided to a prior version of the International Space Station (ISS) Medical Checklist, which outlines the initial diagnostic and treatment steps recommended during space flight for various conditions which may be encountered onboard the ISS. Further diagnostic and treatment procedures beyond the initial steps outlined in the Medical Checklist are then recommended by the ground-based Flight Surgeon, depending on the clinical scenario. Please note that this version does not represent current diagnostic or treatment capabilities available on the ISS. While more recent versions of this document are not accessible to the general public, the provided version of the checklist can still provide a general sense of how medical conditions are handled in the space flight environment. Medical Checklists will be developed for exploration missions at a later point in time.

Please note this file is over 20 megabytes (MB) in size, and may take a few minutes to fully download.

ISS Medical Checklist (http://www.nasa.gov/centers/johnson/pdf/163533main_ISS_Med_CL.pdf)

Capabilities Needed for Diagnosis

The following is a hypothetical list of capabilities that would be helpful in diagnosis. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Light source (such as penlight)
- Tongue depressor
- Imaging (such as dental X-ray)

Capabilities Needed for Treatment

The following is a hypothetical list of capabilities that would be helpful in treatment. It does not necessarily represent the current capabilities available onboard current spacecraft or on the ISS, and may include capabilities that are not yet feasible in the space flight environment.

- Explorer/probe
- Medication delivery device (dental syringe and needles, Carpuject)
- Analgesics (non narcotic, narcotic, oral, injectable)
- Local analgesics (dental injection)
- Gauze pad
- Cotton pellet
- Eugenol anesthetic cartridge
- Antibiotics
- Crew medical restraint system

Associated Gap Reports

The NASA Human Research Program (HRP) identifies gaps in knowledge about the health risks associated with human space travel and the ability to mitigate such risks. The overall objective is to identify gaps critical to human space missions and close them through research and development. The gap reports that are applicable to this medical condition are listed below. A link to all of the HRP gaps can be found here (<http://humanresearchroadmap.nasa.gov/Gaps/>).

- 1.01 - We do not know which emerging technologies are suitable for preflight medical screening for exploration missions.
- 2.01 - We do not know the quantified health and mission outcomes due to medical events during exploration missions.
- 2.02 - We do not know how the inclusion of a physician crew medical officer quantitatively impacts clinical outcomes during exploration missions.
- 3.01 - We do not know the optimal training methods for in-flight medical conditions identified on the Exploration Medical Condition List taking into account the crew medical officer's clinical background. (Closed)
- 3.03 - We do not know which emerging technologies are suitable for in-flight screening, diagnosis, and treatment during exploration missions.
- 4.01 - We do not have the capability to provide a guided medical procedure system that integrates with the medical system during exploration missions.
- 4.02 - We do not have the capability to provide non-invasive medical imaging during exploration missions.
- 4.09 - We do not have the capability to provide medical suction and fluid containment during exploration missions.
- 4.11 - Limited dental care capabilities (Closed)
- 4.14 - We do not have the capability to track medical inventory in a manner that integrates securely with the medical system during exploration missions.
- 4.15 - Lack of medication usage tracking system that includes automatic time stamping and crew identification
- 4.17 - We do not have the capability to package medications to preserve stability and shelf-life during exploration missions.
- 4.24 - Lack of knowledge regarding the treatment of conditions on the Space Medicine Exploration Medical Condition List in remote, resource poor environments (Closed)
- 4.27 - We do not have the capability to sterilize medical equipment during exploration missions.
- 5.01 - We do not have the capability to comprehensively manage medical data during exploration missions.

Other Pertinent Documents

List of Acronyms

D	
DRM	Design Reference Mission
E	
EMCL	Exploration Medical Condition List
EVA	Extravehicular Activity
I	
ISS	International Space Station
M	
MB	Megabyte

N	
NEA	Near Earth Asteroid
X	
X-ray	Radiograph

References

1. Beltran-Aguilar ED, Barker LK, Cantro MT, Dye BA, Gooch BF, Griffin SO, et al. Surveillance for dental caries, dental sealants, tooth retention, edentulism, and enamel fluorosis—United States, 1988-1994 and 1999-2002. *MMWR Surveill Summ* 2005 Aug 26;54(3):1-43.
2. Selwitz RH, Ismail AI, Pitts NB. Dental Caries. *Lancet*. 2007 Jan 6;369(9555):51-9.
3. Hodapp MH. Dental Concerns. In: Barrat M, Pool S, editors. *Principles of Clinical Medicine for Space Flight*. New York: Springer; 2008. P. 545-57.

Last Update

This topic was last updated on 8/12/2014 (Version 2).

Retrieved from "https://humanresearchwiki.jsc.nasa.gov/index.php?title=Dental_-_Caries&oldid=5643"

Category: Medical Conditions

-
- This page was last modified on 12 August 2014, at 15:03.